The Health Issues of the Homeless and the Homeless Issues of the Ill-Health

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Abstract

In public policy planning and budgeting, the health issues and homeless issues tend to be interrelated and reinforced by each other, but this mutual causality is usually ignored in the existing literature. This paper provides an unbiased estimate of a structural equation model taking endogeneity into account. A questionnaire is designed based on the health-related quality of life (EQ-5D) framework and is given to 322 homeless individuals. Evidence shows that, without timely support, the homeless state and health state will fast deteriorate and reinforce each other. It is therefore arguable to broaden the definition of statutory homelessness, and the "preventative approach" can save, rather than increase, the public resources spent on the homeless.

Key Words: Socio-Economic Policy; Health Needs; Homeless; Structural Equation Model

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1 Introduction

One in every 200 people in the UK are homeless (Homeless Link, 2018). Homelessness can be a devastating experience, and the homeless people's lives can quickly spiral out of control, leaving them vulnerable to mental and physical health problems (Hsieh, 2016; Elwell-Sutton et al, 2016), violent crime and problems with drugs and alcohol due to healthcare disparities (Fazel et al., 2014, Fitzpatrick et al., 2015, Newman, 1992, Teruya et al., 2010). Meanwhile, evidence also shows that homelessness issues can originate in or be exacerbated by health issues, especially mental illness and learning disability (DCLG, 2012, Homeless Link, 2016, Welsh Government, 2015). However, the feedback effect from health to homelessness is either ignored or downplayed in the existing studies of the health of homeless people. Obviously, overlooking the mutual causality (or endogeneity/simultaneity in the econometric jargon) will result in biased estimation and misleading policy implications on the health issues of the homeless. Therefore, this paper aims to answer the following two practical questions: *How are health issues and the homeless issues mutually correlated? And how can we improve the efficiency of government interventions provided to the homeless?* To answer the questions, we collect primary data by questionnaire directly from the homeless people in Wales, because Welsh government is the first subnational government in the UK emphasizing the "preventative approach"[3] to homelessness in Housing Act (Welsh Government, 2014). We first paint a complete picture of the health status of the homeless, taking into account the interdependence between homelessness and health. Both descriptive cross tabulations and formal structural modelling are employed. Based on this positive analysis, we then draw policy implications on how to improve the efficiency of the interventions. It is argued that it is advisable to broaden the definition of statutory homelessness, and the "preventative approach" can save, rather than increase, the public resources spent on the homeless.

[3] The Act gives councils strengthened duties to "take reasonable steps" to "help to prevent homelessness" and "to help to secure accommodation" for those already homeless.

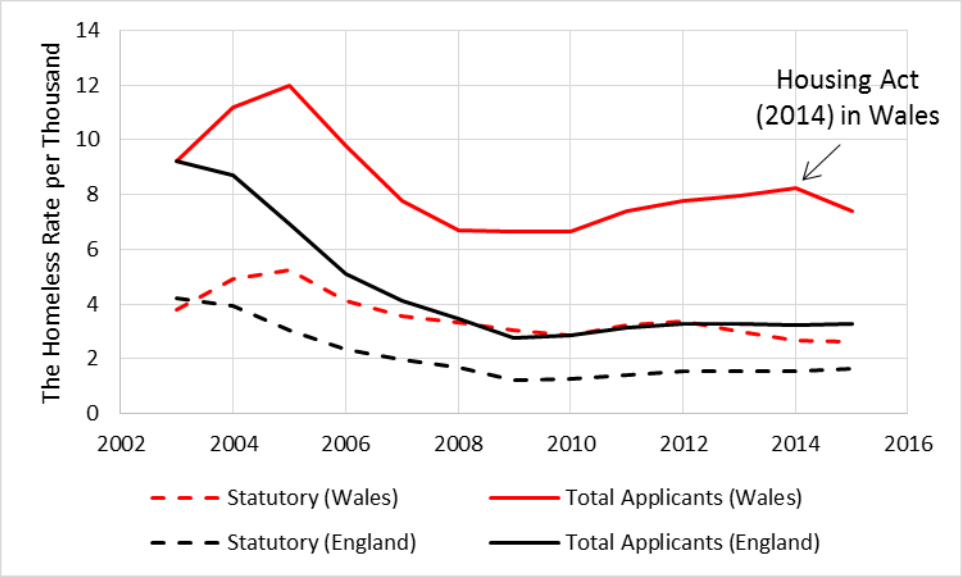

Figure 1 Proportions of the Homeless in England and Wales (Source: ONS)

Recent literature on the health of the homeless covers the US (Barrett et al., 2011, Daiski, 2007, Kehn et al., 2013, Nickash and Marnocha, 2009, Teruya et al., 2010), Canada (Crawley et al., 2013, Watson et al., 2016), Sweden (Sun et al., 2012) and the UK (Fitzpatrick et al., 2015, Loopstra et al., 2015, Elwell-Sutton et al., 2016). Based on these findings, a number of comparative studies across high-income countries are also conducted (Fazel et al., 2014, Fitzpatrick-Lewis et al., 2011, Hwang and Burns, 2014). This paper takes a closer look at the individual-level survey data collected in Wales, because after the Housing Act 2014, Welsh local authority councils now have a legal obligation to offer real support to anyone at risk of or facing homelessness. The experience in Wales could provide a lesson to other sub-national jurisdictions. Moreover, the proportion of homeless people in Wales are higher than that in England, implying a greater significance of the homelessness. Figure 1 compares the proportions of total applicants and statutory homelessness[4] in England and Wales. A relative higher rate in Wales confirms the negative relationship between economic growth and homeless population (Loopstra et al., 2015). The homeless rate in Wales declines after the Act is introduced, in contrast to the flat trend in England. The statutory homelessness accounts for 42.1% of the total applications in Wales and 46.3% in England. A caveat for interpreting the ONS figures above is that they do not include the "hidden homelessness", in which case people facing accommodation difficulties do not present themselves to councils. The difficulties can result from concealed households, sharing accommodation and overcrowded households. The estimated UK population suffering from the three types of hidden homelessness are respectively 33,000, 14,500 and 36,000 in 2014 (Fitzpatrick et al., 2015), compared to the formal applications (15,855 cases) and the approved statutory homelessness (5,115 cases) in the same year (ONS,

[4] The statutory homelessness are the applications approved/accepted by local authority councils.

2015). The hidden homeless account for 84% of all cases, similar to the estimates by other studies (Crawley et al., 2013). Therefore, a broader definition of homelessness including the hidden homelessness is adopted here.

2 Methods

This section discusses the methods adopted for questionnaire design, data sampling and data analysis. Both descriptive and structural modelling methods are used to analyse the conceptual framework between the health issues and homeless issues.

2.1 The Conceptual Model

Accommodation and health are two interrelated "fundamental commodities" (Grossman, 1972), so it is reasonable to address "*the health issues of the homeless*" in combination with the "*the homeless issues of the ill-health*". Ignoring the latter essentially omits the feedback mechanism (the "vicious circle") and underestimates the costs of failing to provide timely interventions. In econometric modelling, this is also called simultaneity or endogeneity problem, which will lead to biased estimates. In the light of this argument, a conceptual framework (Figure 2) taking into account the mutual causality underlies the questionnaire given to the homeless.

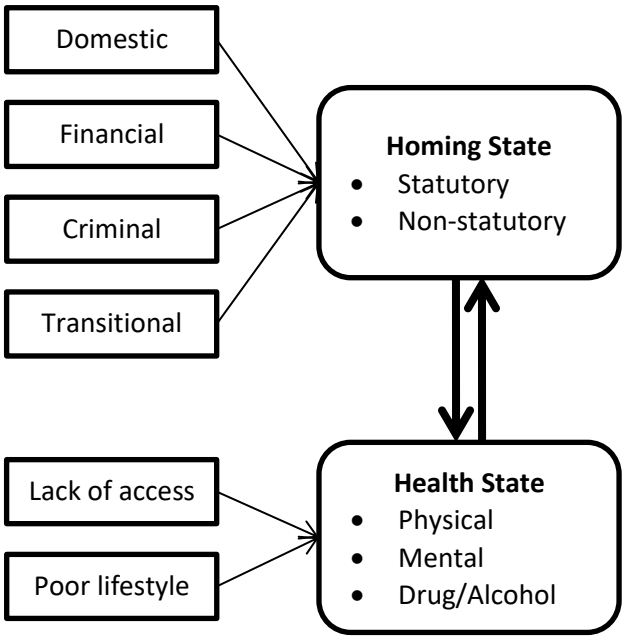

Figure 2 The Conceptual Model of the Vicious Circle between Homeless and Health

To measure the relationships between the homing state and health state, we further distinguish between two types of homelessness (statutory or non-statutory) and three types of health issues (physical, mental, drug/alcohol use). In particular, the statutorily homeless people are defined

as “those accepted as homeless state by councils”, and the non-statutorily homeless people are “those either not accepted as homeless state by councils or did not present themselves to councils for help (i.e. the hidden homelessness)”. The policy design is such that the statutory homelessness reflects long-term and serious homeless issues.

In addition to homelessness, two further reasons are considered to cause the health issues of the homeless: lack of access to healthcare and poor lifestyle. Therefore, to improve the health conditions of the homeless, two corresponding measures can be taken, i.e. to improve the access to the healthcare services and to promote a healthy lifestyle of the homeless people.

2.2 The Stratified Sampling

The individual-level data are collected by the Homeless Health Needs Audit (HNA) of Homeless Link, which adopts stratified sampling to reflect the population structure. There are in total 322 usable observations from 22 local authority districts with a geographic distribution similar to the population counterpart (Welsh Government, 2016). The small sample size makes it difficult to conduct the analysis at the local authority level. Moreover, it is reasonable to group the 22 local authority districts into 7 health boards (HBs) to reflect the current healthcare provision management. The mapping between the two geographic divisions are shown in Table 1.

Health Boards		**Local Authority Districts**
Abertawe Bro Morgannwg University	(ABMU)	Swansea, Neath Port Talbot, Bridgend
Aneurin Bevan	(AB)	Blaenau Gwent, Caerphilly, Monmouthshire, Newport, Torfaen
Betsi Cadwalader University	(BCU)	Anglesey, Conwy, Denbighshire, Gwynedd, Flintshire, Wrexham
Cardiff & Vale University	(CVU)	Cardiff, Vale of Glamorgan
Cwm Taf	(CF)	Merthyr Tydfil, Rhondda Cynon Taf
Hywel Dda	(HD)	Ceredigion, Pembrokeshire, Carmarthenshire
Powys Teaching	(PT)	Powys

Table 1 Mapping between Health Boards and Local Authority Districts

The age structure of the sample has a heavier weight towards the young people compared to the population demography (Census, 2011). One of the reasons may be that older individuals have less IT skills and therefore are less likely to fill the questionnaire, so we have to be careful that the young group may be over-represented due to this self-selection. The sample also contains more male (63%) than female (37%) individuals. Among the 322 respondents, 96% are white, and 94% are UK citizens, but only 2 of them are refugees. 84% of the respondents have recourse to public funds or benefits.

Among all these homeless individuals, 27% of them have "*long-term sickness or disability*", and another 9% have "*temporary sickness or disability*". These homeless individuals with health issues account for more than one third of the sample, supporting the link Health → Homeless in the conceptual model.

2.3 Confronting the Model with the Data

This paper uses two quantitative methods of empirical analysis. One is descriptive cross tabulation which remains the most popular method in the homeless literature (Barrett et al., 2011, Crawley et al., 2013, Watson et al., 2016). Using this simple method, the health issues are investigated across local authority districts, age groups, gender, health states and homeless states. Though simple, cross tabulation can reveal informative patterns and trends in the geographic and demographic dimensions. This evidence can be used to formal modelling later on. The second method is the structural equation model (SEM) to systematically quantify the mutual causality between homeless and health state. As a pair of complementary methods, cross tabulation is used to confirm the qualitative features of the model, while SEM can provide an unbiased quantification.

3 Descriptive Findings of the Homeless State

In terms of the statutory status, we can distinguish between two types of homelessness:

- Statutory Homelessness: accepted as homeless by local councils.
- Non-statutory Homelessness: either not accepted as homeless by local councils or did not present themselves to local councils at all.

This distinction is meaningful because the statutorily homeless people are facing more long-term and serious homeless issues than those who are non-statutorily homeless. Also, the statutorily homeless are likely to have greater health needs[5], and they are supposed to have better access and information due to the help and support from the councils.

Apart from Cwm Taf (where all homeless people are statutory), other HBs seem to have similar proportions of non-statutorily homeless. Therefore, the regional difference in the proportion of the statutorily homeless is not remarkable. This distribution can be further decomposed by gender and age. In most HBs, the demographic structure of the statutorily homeless people is quite similar. There are two exceptions: Abertawe Bro Morgannwg University has remarkably more female homeless individuals presented to the council than the other HBs, while Cwm Taf has more young homeless people (age group 16-25), where all of the homeless are statutory.

[5] 70% of the statutorily homeless people have physical health needs, compared to 63% of the non-statutorily homeless people. For mental health needs, it is 82% (statutory) versus 68% (non-statutory).

One question to ask is whether statutory homelessness state makes any difference to their health state. Or in other words, do councils play a significant role to improve the statutorily homeless people's health. It is believed that presentation to councils can improve the access to the information to the homeless people when they are in need. This conjecture is confirmed later in the data analysis.

Another question is to ask the reverse—how health issues contribute to homelessness? To answer this, the questionnaire identifies all the reasons for being homeless, so that we can quantify the relative importance of health issues in being homeless. The top three primary reasons are: (i) parents/care-givers no longer able/willing to accommodate; (ii) eviction or threat of eviction; and (iii) non-violent relationship breakdown with partner. In contrast, the top three secondary reasons are: (i) other relatives or friends no longer able/willing to accommodate; (ii) drug or alcohol problems; and (iii) mental or physical health problems. The health issues account for 4% as primary reason and 10% as secondary reasons for homeless. If we include "drug or alcohol problems" as part of the broadly defined health issues, then it would account for 13% and 21% respectively. If we combine the primary and secondary reasons (Figure 3), then 33% think that they are homeless due to some health problems. This implies that health issue plays an important role, and the link Health → Homeless in the conceptual model is verified.

The reasons can be grouped into five general categories (as in the conceptual model): (i) domestic[6], (ii) financial[7], (iii) criminal, (iv) transitional[8], as well as (v) health, which are further decomposed into physical, mental and drug/alcohol issues. Figure 3 summarises the proportions of homeless people answering "yes" to each category (as either primary or secondary reasons). Among others, 33% of the respondents think their homeless status is due to health issues, both physically (e.g. heart problems, chronic breathing problems, cancer) and mentally (e.g. depression, anxiety disorder, post-traumatic stress disorder).

4 Descriptive Findings of the Health State

There are three broadly defined health issues, including the physical health, mental health and drug/alcohol use. Overall, 57% respondents state that they have "*long-standing illness, disability or infirmity*". Their health needs and their access to support vary in geography (e.g. health board and urban location) and demography (e.g. gender, age). This section focuses on the

[6] This category includes: parents/care-givers no longer able or willing to accommodate, other relatives or friends no longer able or willing to accommodate, non-violent relationship breakdown with partner, abuse or domestic violence, and overcrowded housing.
[7] This category includes: rent or mortgage arrears, other debt-related issues, financial problems caused by benefits reduction, and unemployment.
[8] This category includes: eviction or threat of eviction, end of tenancy (both social and private housing), leaving institutional care (e.g. hospital, prison, care etc.) and others.

health needs of the broadly-defined homeless, including both general health state and the detailed health needs of physical, mental and alcohol/drug issues.

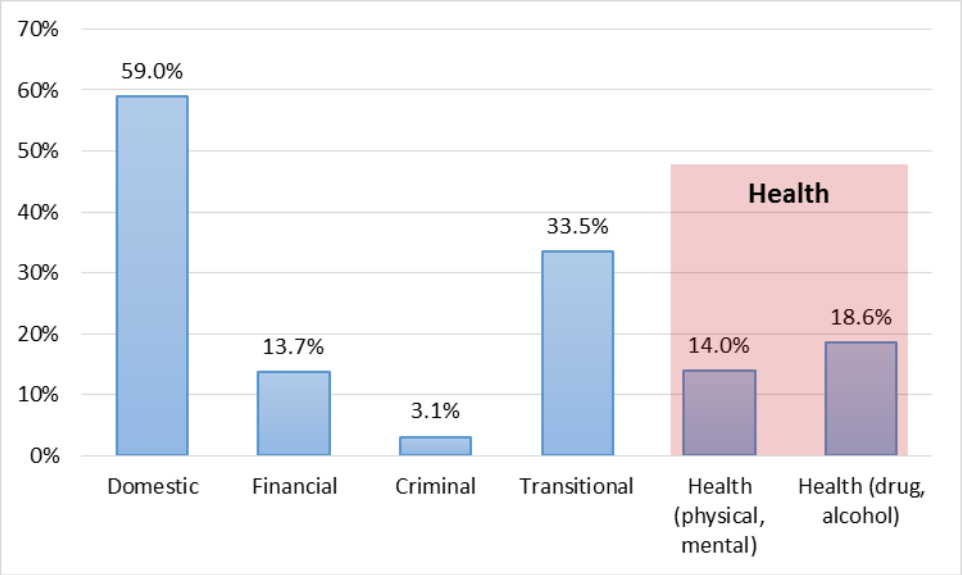

Figure 3 Consolidated Reasons for Being Homeless (Percentages)

A measure of health state is developed based on the health-related quality of life (EQ-5D) model. The respondents are asked to report their overall health state (on a scale from 0 to 100), which has a mean of 62 and median of 65 out of 100. The geographic difference is very small across Welsh HBs. Though Cwm Taf tops the health score league table, and Aneurin Bevan obtains the lowest, the gap between the two extrema is less than 5%.

Health Board	**Gender**		**Age Group**			**Location**	
	Male	Female	16-25	26-49	50+	Rural	Urban
ABMU	59.21	67.88	70.80	60.13	61.25	61.33	65.50
AB	55.64	63.88	72.91	50.17	42.00	62.68	47.22
BCU	61.11	64.51	67.59	61.84	54.50	62.31	NA
CVU	59.20	70.52	70.35	61.53	54.56	70.94	60.29
CT	70.00	50.00	57.14	85.00	70.00	64.00	NA
HD	60.21	67.14	77.73	51.18	63.33	61.77	NA
Overall	60.90	63.99	69.42	61.64	57.61	63.84	57.67

Table 2 The Geographic Variation of Overall Health State by Gender, Age and Location

Notes: ABMU = Abertawe Bro Morgannwg University; AB = Aneurin Bevan; BCU = Betsi Cadwaladr University; CVU = Cardiff & Vale University; CT = Cwm Taf; HD = Hywel Dda.

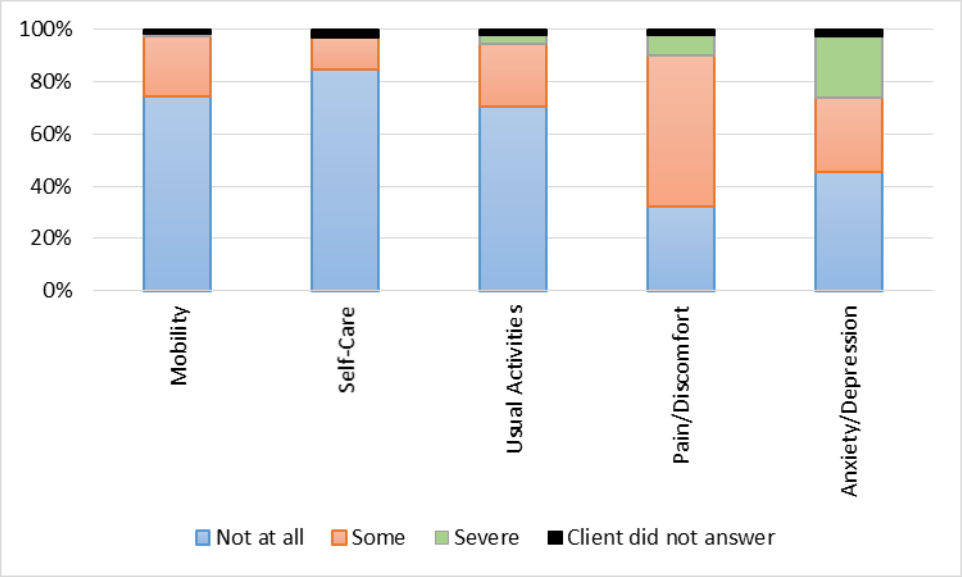

Figure 4 The Health Conditions of the Homeless (EQ-5D)

This general health state can be further decomposed across gender, age and location. The average score is summarised in Table 2. In terms of gender, in all HBs apart from Cwm Taf, the female homeless tend to have better health state than male. Not surprisingly, the older people have lower average health score, but again Cwm Taf is an exception where the youngest age group there has a very low score. By "location", we mean the vicinity to the urban area, and there are three urban local authorities in Wales (Cardiff, Newport and Swansea). There will be some rural areas and some urban areas in each of the three HBs. Evidence shows that the homeless in the urban areas are likely to have worse health state, especially in Newport (Aneurin Bevan). Although Swansea (Abertawe Bro Moregannwg University) has a higher health score in the urban area than its rural counterpart, the score is not significantly higher than the average score of all the rural area.

The non-statutorily homeless are more likely to have worse health state (30%) than the statutorily homeless (26%). This again confirms the positive role of local authority councils in maintaining the health conditions of the homeless via information sharing and service provision. The homeless suffer the most from physical pain/discomfort and mental anxiety/depression. The following subsections will explore the details of the health issues facing the homeless.

4.1 Physical Health Needs

Many of the physical health problems are developed in the past 12 months, indicating a negative impact of homeless status on health. Note that many people have more than one physical issues, because the sum of the percentages exceeds 100%. On average, each homeless person has 2.29 physical health problems. Among the 212 individuals who answered "yes" (either in past 12 months or 12 months+ ago), 150 of them (71%) are currently receiving support or

treatment, but 56 (26%) think they would like more help. However, 22 of them (10%) in need of the support or treatment have not received any.

The physical health needs of the homeless also vary across gender, age and location. Consistent with the general health state, females (60%) are less likely to have physical health needs than males (73%), and older people have significantly stronger needs for physical healthcare than the youngest group (49%). Living in the urban areas again turns out to increase the chance of having physical health needs for the homeless people (84%), compared to those who are living in the rural areas (62%).

4.2 Mental Health Needs

As for the mental health issues, the most popular mental health problems are depression and anxiety, from which more than half of those with mental health issues are suffering. It is also found that the mental health issues are equally serious to the physical health issues—on average, each homeless person has 2.28 mental health problems.

Similar to the physical health needs, the mental health needs of the homeless are different in terms of gender, age and location. Again, on average the male homeless have more health needs (85%) than females (74%), but this pattern is violated in two health boards (ABMU and BCU, see Table 1 for definitions). As for age, the middle group suffers the most mental health issues (90%) than the youngest (73%) and oldest (79%). The urban homeless people have significantly higher mental health needs (87%) than those living in the rural areas (77%).

4.3 Drug/Alcohol Use

Drug/Alcohol use can directly or indirectly affect one's health state. In particular, it may have or will have caused serious physical and mental health problems. Moreover, drug use and alcohol use tend to correlate with each other. Among the 322 respondents, 8% homeless people have both drug and alcohol problems, and only less than two thirds have neither problem. In particular, drug problem seems to be more severe (about a quarter) than the alcohol problem (about one fifth).

	Alcohol Use = 0	Alcohol Use = 1	Total
Drug Use = 0	204 (63.4%)	36 (11.2%)	240 (74.5%)
Drug Use = 1	56 (17.4%)	26 (8.1%)	82 (25.5%)
Total	260 (80.7%)	62 (19.3%)	322 (100%)

The geographic and demographic differences of the drug/alcohol use are similar to the features identified previously in physical and mental health needs. The groups with stronger needs are males, middle aged and urban residents.

Compared to the research done by Homeless Link (Homeless Link, 2014), the homeless people in Wales have about 30% higher chance to suffer from both physical and mental health problems than their counterparts in England, but about 10% less likely to be subject to drug issues. However, these figures are much lower for the general public in England[9]: the proportions are less than halved for physical health, less than a third for mental health, and only one fifth for drug use problems.

Proportions with Health Issues	The Homeless (Wales)	The Homeless (England)	General Public (England)
Physical Health	68%	41%	28%
Mental Health	78%	45%	25%
Drug Use	25%	36%	5%

Table 3 Comparison of the Health State between England and Wales

4.4 Determinants for the Health of the Homeless

To verify the conceptual model, the questionnaire has identified and designed two classes of factors (apart from the homeless state) that affect the health state, i.e. the access to healthcare services and the lifestyle to stay healthy. In addition, the homeless people are facing extra difficulties in both, i.e. Homeless → Health, but this mechanism is considered more systematically in the structural equation model in the next section.

Different health needs are subject to different access difficulties. Those who have not received the treatment when they are in physical or mental health needs are further asked the main reasons. The most important reason is "*couldn't get an appointment*" (30%) for the physical health issues and "*waiting list*" (26%) for the mental health issues. These two reasons together account for about half of the lack of access to the healthcare services for both physical and mental health issues. In particular for the mental healthcare services, 13% of them linked the lack of access to the drug/alcohol use, which should be paid special attention to in trying to improve the physical and mental health conditions. It is like a "supply chain" of health destruction, where drug/alcohol use not only is a health issue *per se* but also affects the "downstream" physical/mental health state.

Similarly, for those who answered "yes" to either drug or alcohol problem, they are further asked if they received any support/treatment. If we combine "*Yes, but I'd still like more help*" and "*No, but it would help me*" as the category of lack of access, then about 40% of those homeless people suffering from drug/alcohol problems need better access to the healthcare services. For those who received support/treatment, the most popular form for both drug and alcohol problems is advice and information (e.g. from GPs, A&E departments). Other more

[9] The comparable data for the Welsh general public are not available.

formal treatments, such as detox, residential rehabilitation and aftercare, still account for a low percentage. That is to say, not only is there lack of access to the healthcare service, but also the quality of healthcare service can be improved.

In general, there are three phases of accessing the healthcare services: pre-use (registration), use, and post-use. The questionnaire covers all the three phases.

Pre-Use. Among all the homeless respondents, there are 9% people not yet registered with GP or homeless healthcare service, and this is much worse for dentist registration—more than half of them (51%) do not register. 3% and 7% of them have being refused registration to a GP and dentist respectively. The main reason for being refused in GP registration is not well given, but for dentist registration, the main reason is the limited availability of places. Further decomposed by the geography, it is surprising that urban areas like Cardiff, Newport and Swansea do not have lower unregistration rate of GP/dentist compared to other HBs. The two unregistration rates have a significant and positive correlation coefficient of 63%, suggesting that if an HB has high unregistration rate of GP, then it is also likely to have a high unregistration rate of dentist. In most HBs, the females have higher registration rates for both GP and dentist than males (GP: 93% versus 90%; dentist: 62% versus 38%), but the registration of dentist is much lower for both female and male homeless. Furthermore, there is a different trend between GP and dentist registration rates over different age groups and rural/urban areas. The middle-aged people (26-49) have the highest GP registration rate (95%), but the youngest group (16-25) have the highest dentist registration rate (55%). Those who live in the urban area have a slightly higher GP registration rate, but a lower dentist registration rate, compared to those who live in the rural areas.

Use. Over 80% of them have been to GP or homeless healthcare service at least once, more than 40% have been to A&E or admitted to hospital, and more than 30% have used an ambulance. Among the reasons for using A&E, ambulance and inpatient, physical health problem and suicidal behaviour are the two most conspicuous contributors (about 40%), while drug use and alcohol use are also remarkable, accounting for about 20% of the use of healthcare services.

Post-Use. On discharge, only 65% of them are asked if they have anywhere suitable to go, and 11% of them are discharged onto the street. Although 77% of them are discharged into accommodation, 13% of them said "*it was not suitable for my needs*". A poor post-discharge care may increase the chance of being readmitted to hospital. As shown in the table below, the chance of being readmitted is doubled if no suitable post-discharge care is arranged. This is another evidence for the vicious circle (Homeless → Health).

Ultimately, people want health, rather than healthcare. The lack of access is a supply-side problem of the healthcare providers such as GP, hospital and homeless healthcare service, but there is also a demand-side problem of poor lifestyle from the homeless people themselves. A better maintenance of their health can reduce the demand and need for healthcare services.

Four general areas of a healthy lifestyle are asked in the questionnaire: (i) vaccination, (ii) regular check-up (different for the elderly and the female), (iii) nutrition and (iv) exercise. It turns out that over 70% of the respondents never get vaccination against hepatitis B and flu. A similar proportion do not have a sexual health check and a quarter of them do not know where to go for advice for sexual health or free contraception. For the homeless over 40 years old, over 60% do not have an NHS health check in the past 12 months, and at least half of the female respondents fail to do cervical smear or breast examination on a regular basis. About 40% of them have only one meal a day, and more than 70% of them have less than one portion of fruit a day. Lastly, 46% of them never do any exercise.

It is arguable that it is more economically efficient to maintain a good lifestyle to stay healthy rather than to spend resources on providing more medical care. It is suggested that each HB should increase the investment on day-to-day health maintenance, such as vaccination, check-up, foodbank and public exercise facilities, given its greater return to health. This can also effectively mitigate the pressure on the scarce healthcare resources.

5 The Structural Equation Model

The sections above have descriptively summarised the homeless issues and health issues as well as the interactions between them. The conceptual model is qualitatively verified and supported by the evidence revealed in the questionnaire data. Nevertheless, this descriptive way of data analysis (cross tabulation) does not control for other dimensions when studying one particular issue. A more systematic and strict modelling approach—the structural equation model (SEM)—is used to quantify the relationship between the two central issues reflected in the conceptual model while taking into account of the mutual causality and other factors simultaneously. To the best of the author's knowledge, this paper is the first in the literature using this advanced modelling approach, though there are some simpler attempts of adopting reduced-form regression approaches, e.g. logit model (Teruya et al., 2010) and fixed effects model (Loopstra et al., 2015) which are still subject to simultaneity biasedness.

To provide a robustness check, the structural relationship between homeless and health issues are estimated in a number of variants of the conceptual model, depending on which measure of homelessness is adopted.

There are two sets of structural equations according to the conceptual model, i.e. Health → Homeless, and Homeless → Health. The baseline SEM is a system trying to capture the mutual causalities among the three endogenous variables simultaneously:

Health → Homeless Equation: $\Pr(homeless = 1) = f(physical, mental, etc.)$

Homeless → Health Equation 1: $\Pr(physical = 1) = g(homeless, etc.)$

Homeless → Health Equation 2: $\Pr(mental = 1) = h(homeless, etc.)$

According to the conceptual model and the questionnaire design, we use a probit model to model the determination mechanism of "homelessness", the degree of which is measured by whether the individual is accepted as statutorily homeless. The regressors include geographic locations, demographic characteristics and self-reported reasons for being homeless (as excluded instruments).

Dependent Variable	Statutory Homelessness	
	(1)	(2)
Abertawe Bro Morgannwg University	-0.1297	-0.1236
Aneurin Bevan	-0.1913*	-0.1891*
Betsi Cadwalader University	-0.1854*	-0.1771*
Cwm Taf	0.0000	0.0000
Hywel Dda	-0.1698	-0.1279
Urban	-0.2910***	-0.2668***
Age Group 26-49	-0.0033	0.0364
Age Group 50+	-0.1380	-0.1134
Female	-0.0355	-0.0292
Homosexual	0.1376**	0.1332*
Non-White Race	-0.1882	-0.1721
Domestic Reasons	0.0692	0.1456*
Financial Reasons	0.0397	0.1024
Criminal Reasons	-0.0497	0.0288
Transitional Reasons	0.0401	0.0557
Physical Health Issues	**0.1264***	**0.1387****
Mental Health Issues	**0.1957*****	
Drug/Alcohol Issues	-0.0320	0.0840

Table 4 summarises the estimated marginal effect of the homelessness equation. We can identify three general trends. Firstly, most self-reported reasons for homelessness (domestic, financial, criminal and transitional) do not significantly contribute to the statutory homelessness. There is strong evidence showing that the main contributor for the homeless status is the health problems, with mental issues (19.6% higher) more influential than physical issues (12.6% higher). If we replace the diagnosed health problems by the individual's personal judgement

on their health problems, then the effect lies in between (13.9% higher). There is no strong evidence for drug and alcohol use to affect one's probability of registering homeless. Secondly, a typical homeless individual in most health boards shares similar probability of registering with local authority councils, but Aneurin Bevan HB and Betsi Cadwalader University HB have significantly lower probability (about 20%) than the others. In particular, if a homeless person is from the urban area (i.e. Cardiff, Swansea and Newport), then the chance of being statutorily homeless is even lower (26.7%~29.1% lower) than rural areas. Lastly, there is no significant difference of being statutorily homeless across different age groups, but there is weak evidence that the youngest group (16~25) seems to have the highest chance. There is no significant difference either by gender or by race, but the homosexual people are more likely to register as homeless.

Dependent Variable	Statutory Homelessness	
	(1)	(2)
Abertawe Bro Morgannwg University	-0.1297	-0.1236
Aneurin Bevan	-0.1913*	-0.1891*
Betsi Cadwalader University	-0.1854*	-0.1771*
Cwm Taf	0.0000	0.0000
Hywel Dda	-0.1698	-0.1279
Urban	-0.2910***	-0.2668***
Age Group 26-49	-0.0033	0.0364
Age Group 50+	-0.1380	-0.1134
Female	-0.0355	-0.0292
Homosexual	0.1376**	0.1332*
Non-White Race	-0.1882	-0.1721
Domestic Reasons	0.0692	0.1456*
Financial Reasons	0.0397	0.1024
Criminal Reasons	-0.0497	0.0288
Transitional Reasons	0.0401	0.0557
Physical Health Issues	**0.1264***	**0.1387****
Mental Health Issues	**0.1957*****	
Drug/Alcohol Issues	-0.0320	0.0840

Table 4 The Estimated Relationship Health → Homeless

Notes: Column (1) is the baseline estimation with diagnosed physical/mental health issues, while column (2) is to provide robustness by replacing the two regressors by the individual's personal judgement on the reasons causing their homeless status. The base group is Cardiff & Vale University HB and the age group of 16-25. Significance level: * 10%, ** 5%, ***1%. Sample size: 322.

The causation goes the other way. The homeless state, especially that caused by long-term issues, will exacerbate the individual's health through various channels. The conceptual model

and the questionnaire identify two sources: the access and the lifestyle, in addition to other control variables common to the previous equation.

The estimated mutual causality is illustrated in the following chart. It is found that if the individual is statutorily homeless, then the health score tends to be 6.18% lower than those non-statutorily homeless people, with higher chances of having physical (12.8% higher) and mental (13.8% higher) health problems. The last column of Table 5 uses the overall self-reported health score as the dependent variable to provide robustness check of the conclusions of the baseline model. Note that the health score measure is higher when the health state is better, while the other two measures are reverse—if physical/mental is equal to 1, then you have health issues, so it is worse than 0. Thus, we expect to see reverse signs on the first and the last two columns.

Dependent Variable	Physical	Mental	Health Score
Abertawe Bro Morgannwg University	-0.0463	0.1429***	-0.0153
Aneurin Bevan	0.0823	0.0523	-0.0860*
Betsi Cadwalader University	-0.0317	0.1735***	-0.0455
Cwm Taf	0.0357	0.1704***	-0.0501
Hywel Dda	0.1269	0.1720***	-0.0610
Urban	0.2143***	0.1440**	-0.0464
Age Group 26-49	0.2005***	0.1657***	-0.1088***
Age Group 50+	0.1872***	0.0129	-0.1629***
Female	-0.0048	-0.0307	0.0141
Homosexual	-0.1181	0.0239	-0.0620
Non-White Race	-0.0719	-0.0786	0.0021
Registered GP	-0.0004	0.0609	0.0151
Registered Dentist	-0.1079*	-0.0504	0.0460
Vaccination	0.0892	-0.0032	-0.0164
Checkup	-0.0093	0.1010**	0.0447
Nutrition	-0.0523	-0.0647	0.0447
Exercise	-0.0666	0.0029	0.0392
Statutory Homelessness	**0.1277****	**0.1383****	**-0.0618***

Table 5 The Estimated Relationship Homeless → Health

Notes: The "physical" and "mental" columns are the equations on whether or not the individual is diagnosed to have any physical or mental health issues. The base group is Cardiff & Vale University HB and the age group of 16-25. The column "health score" provides robustness by the self-reported health score on the scale of 0~100 (EQ-5D), and the coefficients are marginal effect (need to multiply 100 to see the percentage effects on the health score) to be comparable to the other two equations. Significance level: * 10%, ** 5%, ***1%. Sample size: 322.

Geographically, there is no clear difference across different health boards in terms of health scores and physical health state, but a typical homeless individual from Cardiff and Vale University HB has significantly lower chance of having mental health issues (about 15% lower). However, the urban areas as a whole are more likely to impose both physical (21.4% higher) and mental (14.4% higher) problems to the homeless. Consistent with previous conjecture, the older people are likely to have lower health score and higher chance of health problems, but there is no significant difference across gender, sex orientation or race. Though statistically insignificant, registration with GP/dentist will reduce the chance of having physical and mental health issues, resulting in a higher health score. Access to the health service does play a key role for the homeless. Moreover, most measures of a good lifestyle (such as vaccination, regular check-up, good nutrition and exercise) do not significantly improve the health score or physical and mental health state. This is not surprising because the major issues that the homeless people are facing are much more substantial than these trivial improvements. Nevertheless, a good lifestyle does raise the health score a little bit by about 4.5%.

To give an intuition of the importance to emphasise the mutual causality, consider a simple numerical example based on the estimation results in Table 4 and Table 5. Consider that a council widens the coverage of the statutory homeless definition by one percent, i.e. from 5,115 (the current statutory homeless people in Wales) to 5,166. With the homeless support, the physical and mental health needs of the homeless people will reduce by 12.66% and 13.83% (Table 5), these reductions in health needs can further reduce the homeless rate by 4.3% (= 12.66%*12.64% + 13.83%*19.57%) based on the estimated marginal effects in Table 4. That is to say, in the long run, the homeless people will finally reduce to 4,944. Therefore, a temporary increase in homeless support will eventually reduce the total expenditure due to the feedback effect between homelessness and health needs.

6 Conclusion

In summary, we have identified some general features of the health state, health needs and healthcare access of the homeless.

- **Geography**: There is no significant difference across Welsh HBs in terms of physical and mental health needs, but living in urban areas (Cardiff, Swansea and Newport) tends to increase the chances for more needs in both physical and mental health.
- **Demography**: Female homeless people on average have generally better health state and less health needs compared to their male counterparts. Older people have more physical health needs, but the middle-aged people tend to have more mental health issues.
- **Access**: The access to healthcare provision can be improved in pre-use (registration), interim-use (support/treatment) and post-use (after discharge). The registration rates of

GP/dentists are positively associated with the chance of meeting the health needs of the homeless, so higher registration rates should be encouraged by all HBs. The two most important reasons for failing to meet their health needs are "couldn't get an appointment" and "waiting list".

- **Lifestyle**: The fundamental need is health rather than healthcare, so a better lifestyle (e.g. vaccination, check-up, nutrition and exercise) should be encouraged to directly improve health. It can effectively reduce the demand for healthcare and efficiently utilise the scarce resources.
- **The Vicious Circle**: The structural equation model quantifies the mutual causality between homeless state and health state in the conceptual model. It is found that being statutorily homeless tends to exacerbate the health state by 6.18%, and suffering from health issues makes them 13.87% more likely to be statutorily homeless.

The structural equation model is constructed to systematically capture and quantify the conceptual model with mutual causality between health state and homeless state. It is confirmed that being statutorily homeless makes the health score lower by 6.18%, and having any physical or mental problem increases the chance of being statutorily homeless by 13.87%. This finding implies that, once an individual enters this vicious circle, either via health issues or via homeless issues, s/he will be trapped within and her/his situation will deteriorate if no external support kicks in. This conclusion reinforces the previous findings (Barry et al., 1991, Crawley et al., 2013, Teruya et al., 2010, Watson et al., 2016), but their effects of homelessness on health are underestimated due to ignoring the mutual causality. A straightforward policy implication is that councils should provide timely support to the homeless to break the vicious circle, preferably at an early stage. It is always more economically efficient and practically effective to adopt a "preventative approach" than late rescue (Self and Grabowski, 2003). The criterion of statutory homelessness should take a forward-looking stance and include those who are potentially developing into the vicious circle.

References

Barrett, B., Fogel, S., Garrett, J., & Young, M. (2011). Assessing Health Care Needs among Street Homeless and Transitionally Housed Adults. *Journal of Social Service Research, 37*(3), 338-350.

Barry, A.-M., Carr-Hill, R., & Glanville, J. (1991). Homelessness and Health: What do We Know? What should be Done? *Centre for Health Economics Working Paper*.

Crawley, J., Kane, D., Atkinson-Plato, L., Hamilton, M., Dobson, K., & Watson, J. (2013). Needs of the Hidden Homeless - No Longer Hidden: A Pilot Study. *Public Health, 127*, 674-680.

Daiski, I. (2007). Perspectives of homeless people on their health and health needs priorities. *Journal of Advanced Nursing, 58*, 273-281.

DCLG. (2012). Evidence Review of the Costs of Homelessness. *Department for Communities and Local Government Publication*, 1-15.

Elwell-Sutton, T., Fok, J., Albanese, F., Mathie, H., & Holland, R. (2016). Factors associated with access to care and healthcare utilization in the homeless population of England. *Journal of Public Health*. doi:10.1093/pubmed/fdw008

Fazel, S., Geddes, J. R., & Kushel, M. (2014). The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. *The Lancet, 384*(9953), 1529-1540. doi:10.1016/S0140-6736(14)61132-6

Fitzpatrick, S., Pawson, H., Bramley, G., Wilcox, S., & Watts, B. (2015). The Homelessness Monitor: Wales 2015. *Crisis*.

Fitzpatrick-Lewis, D., Ganann, R., Krishnaratne, S., Ciliska, D., Kouyoumdjian, F., & Hwang, S. (2011). Effectiveness of interventions to improve the health and housing status of homeless people: a rapid systematic review. *Public Health, 11*, 1-14.

Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health. *The Journal of Political Economy, 80*(2), 223-255.

Homeless Link. (2014). Homelessness and health research.

Homeless Link. (2016). Homeless Health Needs Audit.

Hwang, S. W., & Burns, T. (2014). Health interventions for people who are homeless. *The Lancet, 384*(9953), 1541-1547. doi:10.1016/S0140-6736(14)61133-8

Kehn, M. E., Ho, P. S., & Kroll, T. (2013). Identifying the health service needs of homeless adults with physical disabilities. *Public Health, 127*(8), 785-787. doi:10.1016/j.puhe.2013.01.011

Loopstra, R., Reeves, A., Barr, B., Taylor-Robinson, D., McKee, M., & Stuckler, D. (2015). The impact of economic downturns and budget cuts on homelessness claim rates

across 323 local authorities in England, 2004-12. *Journal of Public Health*, 1741-3842.

Newman, S. (1992). The Severely Mentally Ill Homeless: Housing Needs and Housing Policy. *The Johns Hopkins University Institute for Policy Studies Occasional Paper Series*.

Nickash, B., & Marnocha, S. (2009). Health care experiences of the homeless. *Journal of the American Academy of Nurse Practitioners, 21*(1), 39-46.

Self, S., & Grabowski, R. (2003). How effective is public health expenditure in improving overall health? A cross-country analysis. *Applied Economics, 35*(7), 835-845.

Sun, S., Irestig, R., Burstrom, B., Beijer, U., & Burstrom, K. (2012). Health-related quality of life (EQ-5D) among homeless persons compared to a general population sample in Stockholm county, 2006. *Scandinavian Journal of Public Health, 40*(2), 115-125.

Teruya, C., Longshore, D., Andersen, R., Arangua, L., Nyamathi, A., Leake, B., & Gelberg, L. (2010). Health and Health Care Disparities Among Homeless Women. *Women and Health, 50*(8), 719-736.

Watson, J., Crawley, J., & Kane, D. (2016). Social exclusion, health and hidden homelessness. *Public Health*, 1-7.

Welsh Government. (2014). Housing (Wales) Act 2014.

Welsh Government. (2015). Health of homeless and specific vulnerable groups. *Welsh Government Report*.

Welsh Government. (2016). Population of Wales.